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Groundwater Monitoring Plan

GROUNDWATER MONITORING PLAN

POSSUM POINT POWER STATION
19000 POSSUM POINT ROAD
DUMFRIES, VIRGINIA 22026
CCR IMPOUNDMENTS A, B, C, D, & E

SOLID WASTE PERMIT NO. 617

Dominion Energy

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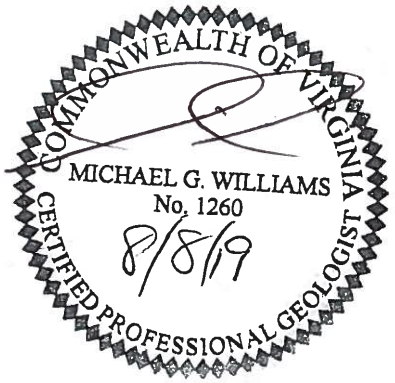

October 2017

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APPENDICES

1.0 INTRODUCTION

This *Groundwater Monitoring Plan* (GWMP) was prepared for the Possum Point Power Station (Station) in Dumfries, Virginia. The location of the Station is shown on Drawing 1. The Station is operated by Virginia Electric and Power Company d/b/a Dominion Energy Virginia (Dominion Energy). As part of the Station operations, Dominion Energy historically operated five surface impoundments (Ponds A, B, C, D, and E) that were used to store coal combustion residuals (CCR). Ponds A, B, C, and E were unlined, and the CCR materials have been excavated and transferred to Pond D, a clay-lined pond, for storage. Pond D is expected to be closed in accordance with the CCR Rule. Consistent with state and federal regulations, Dominion Energy will monitor Pond D with a groundwater monitoring network. Additionally, former Ponds A, B, C, and E, which have been largely excavated, are scheduled for a closure by removal demonstration, which will include a groundwater demonstration in accordance with applicable federal and state regulations. The groundwater demonstration for Ash Ponds A, B, C, and E will include the evaluation of groundwater quality data (modified Assessment Monitoring Program constituents as outlined herein) from the downgradient wells and one well to be constructed within Ponds A, B, C, D, and E.

This GWMP was prepared for the five ponds at the Station and is designed to meet:

- applicable provisions of the U.S. Environmental Protection Agency's (USEPA's) *Disposal of Coal Combustion Residuals* (CCR) *from Electric Utilities* (CCR Rule; Federal Register Vol. 80, No. 74, 21302-21501) as published on April 17, 2015 (40 CFR 257 *et seq*.);
- applicable provisions of USEPA's CCR Rule amendment (Federal Register Vol. 81, No. 151, 51802-51808) as published on August 5, 2016; and
- applicable provisions of the CCR Rule as adopted in the Virginia Solid Waste Management Regulations (VSWMR) on January 27, 2016 (Title 9 Virginia Administrative Code Agency 20, Chapter 81, Section 800 *et seq*.; 9VAC20-81-800; VWMB, 2016); and
- applicable provisions of the Solid Waste Permit No. 617 issued June 2019.

Specifically, this GWMP outlines the procedures for collecting, analyzing, and managing groundwater samples and data from the uppermost aquifer underlying the five ponds. In the event that future amendments to the VSWMR and/or CCR Rule conflict with any provisions of this GWMP, the VSWMR and/or CCR Rule will supersede this GWMP, with the exception of Department of Environmental Quality (DEQ)-approved variances and Alternate Source Demonstrations (ASDs), and permit-specific conditions.

Revisions to this GWMP may be required in the future due to changes in the monitoring network, sampling action, revisions to USEPA or VSWMR regulations, or at the request of the unit owner. Any revisions made to the GWMP will be posted to the operating record and will be submitted to DEQ within 60 days of completion.

2.0 SITE LOCATION INFORMATION

As shown on Drawing 1, the Station is located at 19000 Possum Point Road in Dumfries, Prince William County, Virginia, approximately 35 miles south of Washington D.C. The Station is owned and operated by Dominion Energy and consists of approximately 650 acres on a peninsula that is bordered to the east and south by the Potomac River, and to the west by Quantico Creek. A Site Plan for the Station and the CCR units is presented as Drawing 2.

The Station has two active power generating units: Unit 5 (heavy oil) and Unit 6 (combined cycle). Two of the former generating units that were converted from coal to natural gas in 2003, and two former generating units that were powered by coal have been retired. Historically the Station stored CCR in four unlined impoundments (Ponds A, B, C, and E) and one clay-lined impoundment (Pond D) located on site. The approximate locations of the impoundments are shown on Drawing 2.

2.1 Site Topography and Land Use

As shown on Drawing 1, a portion of the USGS 7½-minute topographic map of Quantico, Virginia, the general area has a gentle to moderate topographic relief. The topographic elevations in the vicinity of the Station range from approximately mean sea level along Quantico Creek to 200 feet above mean sea level (AMSL, National Geodetic Vertical Datum, NGVD). Locally the topography is dissected by swales and water courses that drain towards Quantico Creek. Quantico Creek is a tributary of the Potomac River.

The Station property is used for industrial purposes, and the surrounding properties are generally undeveloped or consist of private residential development. Undeveloped areas primarily consist of predominantly hardwoods and deciduous wooded uplands with wetlands present in low lying areas adjacent to stream channels.

2.2 Climate

Based on available data from the Soil Survey of Prince William County Virginia (1989) and National Oceanic and Atmospheric Administration (NOAA), the prevailing wind in the vicinity of the Station is from the northwest and averages 6.9 miles per hour (mph), with February and March being the months with the highest average wind speed of 9.2 mph. The average annual temperature is 56.9 F, the average daily maximum temperature is 66.6 F, and the average daily minimum is 47.3 F.

Based on statistics from NOAA, the average annual precipitation amount for the Station area is 40.76 inches. Precipitation is distributed throughout the year and averages 3.4 inches per month, with a low of 2.8 inches and a high of 3.9 inches. The average annual snowfall is 12 inches.

2.3 Site History

Drawing 2 shows CCR management areas. These areas are Ponds A, B, C, D, and E. Ponds A, B, and C were constructed *circa* 1955 as a single embankment spanning three existing drainage features collectively covering approximately 10.6 acres. During operation, low-volume wastewaters including CCR flowed through Ponds A, B, and C sequentially until discharging through a riser structure on the northwest side of Pond C. Ponds A, B, and C operated until around 1967. Further expansion of the Station in the 1960s, as well as decreasing available storage in Ponds A, B, and C prompted Dominion to construct an additional pond for ash sluicing. Excavation of the contents of former Ponds A, B, and C began in 2016 and continues to date. Excavated materials from Ponds A, B, and C have been placed in Pond D.

Pond E construction started in 1967 and finished in 1968. Pond E was used as a water treatment pond to settle and manage low-volume wastewaters including CCR beginning in 1968. In the late 1970s, the footprint of Pond E was modified on the eastern edge for construction of a new Metals Pond. The first Metals Pond was constructed in 1979 and a second Metals Pond was constructed north of the first, and adjacent to Pond E, in the early 1990s. Pond E covered approximately 35.6 acres. Excavation of the contents of former Pond E began in 2016 and was completed in 2017. Excavated materials from Pond E were placed in Pond D.

Pond D was constructed in 1988 for additional sluiced ash storage. The discharge from Pond D was routed into the southeastern corner of Pond E to provide additional settling capacity. Pond D is a partially clay-lined impoundment that covers approximately 63.4 acres. In 2003, the Station converted from a coal-fired power plant to a natural gas-fired power plant, and the pond was not used for newly produced ash after this conversion. Pond D is scheduled for closure by removal.

Groundwater monitoring at the Station has occurred since 1985 under a Virginia Pollutant Discharge Elimination System (VPDES) permit. The Station submitted a Site Characterization Report (SCR) in September 2004 for groundwater at Ash Pond D and Ash Pond E. The results of the SCR concluded that groundwater conditions at the Site did not pose a risk to identified offsite human health or environmental receptors.

On October 24, 2007, the Virginia Department of Environmental Quality (DEQ) reissued VPDES permit number VA0002071, altering effluent limitations and groundwater monitoring requirements. As required under the reissued permit, Dominion submitted a revised GWMP on December 20, 2007, incorporating a semi-annual monitoring schedule. The GWMP was approved by DEQ in a letter dated February 25, 2008. Dominion initiated the first monitoring event under the new plan during the first semi-annual period of 2008. Dominion submitted a revised GWMP on March 14, 2012, removing the specified sampling order. The revised GWMP was approved by the DEQ on April 9, 2012.

Dominion submitted a VPDES permit renewal application to the DEQ prior to the expiration of the 2007 permit on October 23, 2012. The DEQ reissued the VPDES permit effective April 3, 2013. In accordance with special condition in the VPDES permit, Dominion reviewed the GWMP and submitted a revision to incorporate minor changes on July 2, 2013. The July 2013 GWMP was approved by the DEQ on October 4, 2013. In January 2016, the Station's VPDES permit was modified to address the industrial wastewater and stormwater discharges associated with the closure of the ash ponds.

CCR Rule background groundwater monitoring began in November 2016 at Pond D. The background sampling activities for Pond D were completed in August 2017 and the Groundwater Monitoring Certification, Groundwater Monitoring Plan, and Statistical Method Certification were placed in the operating record by October 17, 2017. The initial Detection Monitoring Program event for Pond D was completed in October 2017 and identified statistically significant increases (SSIs) over background levels in one or more downgradient wells. Within 90 days of identifying the SSIs, the Assessment Monitoring Program was established at Pond D by sampling groundwater in all CCR well network wells for all constituents listed in Appendix IV of the CCR Rule. Notification of Assessment Monitoring Program establishment was placed in the operating record on June 3, 2018. CCR Rule background groundwater monitoring for inactive Ponds A, B, C, and E was completed August 2017.

Evaluation of analytical data collected for Pond D during the first semi-annual compliance monitoring event in 2018 resulted in the identification of Virginia Groundwater Protection Standard (GWPS) exceedances for cobalt (ED-1605) and lithium (ED-9R2 and SD-1603). Similar exceedances of the Virginia (ED-1605, ED-1D, and ED-1606) and the federal (ED-1605) GWPS were observed for cobalt during the second semi-annual 2018 event. In response to these exceedances, consistent with the Coal Combustion Residuals (CCR) Rule, Dominion Energy initiated an Assessment of Corrective Measures (ACM) on January 29, 2019.

An ACM field investigation was completed to delineate the vertical and horizontal extent of constituent of concern (COC) concentrations in groundwater that exceed the CCR Rule GWPS in the vicinity of Pond D. To fulfill the requirements of the ACM, eight downgradient groundwater observation wells and one soil boring (MW-1S, MW-1D, MW-3S, MW-3D, MW-4S, MW-4SB, MW-5S, MW-6S, and SB-1) were installed downgradient of ED-9R2, SD-1603, and ED-1605, for hydraulic testing and groundwater sampling. The locations of these wells are shown on Drawing 2. In addition, two interstitial piezometers (PZ-1 and PZ-2) were installed to characterize the interstitial pore water in Pond D. Geological and hydrogeological information collected during the investigation was generally consistent with previous site investigations and confirmed the existing Site Conceptual Model.

The ACM Report, completed on June 27, 2019, summarized the results of the assessment of remedial alternatives for addressing the reported GWPS exceedances based on the results of the field investigation,

the site conceptual model, a Risk Assessment, and Commonwealth of Virginia statutory requirements promulgated during the 2019 General Assembly for CCR source removal from unlined impoundments.

In June 2019, Solid Waste Facility Permit 617 was issued and impoundments A, B, C, D, and E transitioned to monitoring under the modified Assessment Monitoring Program.

3.0 SITE GEOLOGY AND HYDROGEOLOGY

The following sections present a summary of the geological and hydrogeological conditions for the Station and surrounding areas.

3.1 Site Soils

As presented on Drawing 3, a soil survey map obtained from the United States Department of Agriculture (USDA)-operated web soil survey (https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx), the Station and the surrounding area are underlain by soils mapped as the Dumfries sandy loam, Quantico sandy loam, Marr very fine sandy loam, Marumsco loam, and Featherstone silt loam. With the exception of the Marumsco loam and Featherstone silt loam, which are mapped within the floodplain, the mapped soils are described as deep and well drained, as expected for soils associated with upland and sloped areas. The Marumsco loam and Featherstone silt loam are listed as poorly drained soils with a high-water table and grade of less than 4 percent.

3.2 Geology

As presented on Drawing 4 (VDMR, 1993), a geologic map for the study area, the Station and surrounding area are located entirely within the Coastal Plain Physiographic Province of Northeastern Virginia. This province is characterized by transgressive and regressive unconsolidated sediments that generally form broad terraces that slope towards the east. The terraces are transected by surface drainage channels, some of which have since been infilled.

The Station is underlain by Cretaceous marine sediments of the Potomac (Kp) Formation and Tertiary (Tl) to Quaternary (Q) fluvial-deltaic sediments mapped as lower Tertiary terrace deposits (Tl), and the Charles City (Q), Shirley (Q), and Tabb (Q) Formations. These sediments are unconsolidated and consist of clays, silts, poorly to well sorted sands, and gravel that exist as interbedded, discontinuous, horizontal layers across the site. The thickness of the sedimentary sequence ranges up to at least 600 feet as determined by well logs for the surrounding area.

Based on geological data obtained from soil borings advanced at the Station, a Site Conceptual Model has been developed for the Station and surrounding area to assist with the understanding of groundwater flow within the uppermost aquifer beneath Pond D and former Ponds A, B, C, and E. Details for the Site Conceptual Model are presented in Drawings 5 through 9. Drawing 5 is a structural contour map for the top of the Potomac Confining Unit that underlies the study area. The Potomac Confining Unit is considered to be a confining unit for the underlying Potomac Aquifer. Based on available data and as presented on cross sections A-A' through E-E' (Drawings 6 through 10), the Potomac Confining Unit is present across the study area. Therefore, the uppermost aquifer beneath the study area, which is present within the

overlaying Quaternary and Tertiary sediments, is physically and hydrologically separated from the lower Potomac Aquifer.

3.3 Hydrogeology

The uppermost aquifer beneath the study area is present in the Tertiary and Quaternary sediments that overlie the Potomac Confining Unit. Locally, perched water tables are present in the upper sections of the uppermost aquifer sediments. These perched water tables are not hydraulically connected by saturated sediments in the uppermost aquifer. Because the perched water tables (where observed) are present at a higher elevation than the impoundments, monitoring of these perched water tables is not required under the CCR Rule or the VSWMR.

Groundwater measurements collected in July 2017 from wells screened in the uppermost aquifer beneath the study area indicate that the depth to groundwater in the vicinity of Pond D is between 30 and 150 feet depending on topographic elevation. The saturated thickness of the uppermost aquifer is somewhat variable, ranging from 10 to 40 feet locally.

Using surveyed elevation data for the wells, the elevation of the potentiometric surface in the uppermost aquifer was contoured and is presented as an overlay on Drawing 11. As presented on Drawing 11, groundwater elevations range from 80 feet AMSL beneath the upland recharge areas to mean sea level where the uppermost aquifer flows toward Quantico Creek. In general, groundwater flow within the uppermost aquifer beneath the study area is radial in natural, flowing from groundwater recharge areas towards incised channels associated with Quantico Creek and the Potomac River. Locally, tidal fluctuations are observed in monitoring wells that are screened in the Quantico Creek floodplain. The tidal fluctuations are minimal (generally less than 2 feet) and are not observed to result in significant gradient reversals that could impact the ability of a conventional groundwater monitoring network to effectively monitor groundwater.

3.3.1 Uppermost Aquifer Hydraulic Conductivity

The hydraulic conductivity of the unconsolidated sediments comprising the uppermost aquifer beneath the study area was estimated based on description of the sediments comprising the saturated section of the uppermost aquifer beneath the study area and hydraulic conductivity ranges provided by Fetter (Fetter, 1988) for unconsolidated sediments. Based on available information, the hydraulic conductivity of the sediments comprising the uppermost aquifer is expected to be variable ranging from 1E-05 centimeter per second (cm/s) for poorly sorted clay, silt, and sand to 1E-02 cm/s for well sorted sand and sandy gravel deposits, with an overall average value of 2.01E-04 cm/s. Recent hydraulic evaluations completed during the ACM for Pond D in 2019 yielded an average hydraulic conductivity value of 0.571 ft/day for the uppermost aquifer.

3.3.2 Uppermost Aquifer Groundwater Flow Rate

Using the groundwater contours presented as an overlay on Drawing 11, the average hydraulic gradient for the uppermost aquifer in the study area was calculated as follows using the algorithm below.

Area	Starting Head (Elevation ft AMSL)	Ending Head (Elevation ft AMSL)	Distance (feet)	Calculated Gradient (unitless)
Ponds A, B, & C	20	1	638	0.030
Pond D	80	1	3,697	0.021
Pond E	30	1	1,492	0.019

Note: AMSL = Above Mean Sea Level

$$i_{gw} = \left({}^{h_L}/_{L}\right)$$

Where: i_{gw} = gradient
h_L = head loss (elevation difference)
L = length (horizontal distance)

Using the estimated effective porosity value of 20%, the estimated average hydraulic conductivity value of 0.571 ft/day, and the calculated gradient, the average rate of groundwater flow (V_{gw}) in the uppermost aquifer beneath the units was calculated as follows using the algorithm below.

Area	Gradient (unitless)	Effective Porosity	Hydraulic Conductivity (feet/day)	Groundwater Velocity (ft/year)
Pond A, B & C	0.030	0.20	0.571	31.26
Pond D	0.021	0.20	0.571	21.88
Pond E	0.019	0.20	0.571	19.80

Notes:

ft/year = feet per year

$$V_{gw} = K\, i\, (1/n_e)$$

Where:

V_{gw} = Groundwater velocity

K = Hydraulic conductivity

i = Hydraulic gradient

n_e = Effective porosity

3.4 Water Supply Wells

A review of the Virginia Division of Mines Minerals and Energy (VDMR) interactive geologic map reveals the presence of a single industrial water supply well at the Station. The well was installed in 1946 and is located within the electrical generation portion of the Station approximately 3,900 feet south-southeast of Pond D. Data recorded for this well include a depth of 601.5 feet and a water level of 56 feet below grade. According to Station personnel, this well is inactive.

While the immediate area surrounding the Station is serviced by a municipal water supply, some nearby residential dwellings to the west of the Station use private domestic water supply wells. The closest residential supply well is located approximately 2,800 feet west of former Pond E on the west side of a tidal tributary to Quantico Creek. Based on the distance between the CCR units and known residences, the presence of a hydrologic divide, and the expected volume of groundwater use for a typical residence, off-site wells associated with residential structures to the west of the Station are not expected to adversely impact Dominion Energy's ability to effectively monitor the uppermost aquifer beneath the CCR ponds using a conventional groundwater monitoring system.

4.0 DESIGN OF THE GROUNDWATER MONITORING SYSTEM

The monitoring wells proposed for the compliance monitoring network are, or will be, located and constructed with a sufficient number of wells to yield groundwater samples representative of the conditions in the uppermost unconfined aquifer beneath the units that:

- Accurately represent the quality of background groundwater that has not been affected by leakage from the waste management units (CCR units), and
- Accurately represent the quality of groundwater passing the waste boundary of the waste management units (CCR units). The downgradient monitoring system installed at the waste boundary will ensure early detection of groundwater contamination in the uppermost aquifer. Dominion Energy will monitor potential contaminant pathways related to the waste management units (CCR units).

Certification from a qualified professional engineer stating that the groundwater monitoring system has been designed and constructed to meet the requirements of the CCR Rule (40 CFR 257.91(f)) is required. This certification was placed in the unit's operating record on October 17, 2017 in accordance with the recordkeeping requirements of 40 CFR 257.105. Pursuant to 40 CFR 257.106(h) and 40 CFR 257.107(h), the DEQ was notified on November 15, 2017 that the certification was placed in the operating record and on Dominion Energy's publicly available internet site. Any future modifications to the groundwater monitoring system will require DEQ approval and updates to the operating record and publicly available internet site in accordance with the CCR Rule.

Well placement, construction, development, and decommissioning procedures are discussed in the following sections. Monitoring well construction logs for existing wells are provided in Appendix A. Recommended monitoring well construction, development, and decommissioning procedures are included in Appendix B.

4.1 Special Conditions

Special conditions are site conditions that can affect the design of a groundwater monitoring system. These conditions may include:

- Waste management units, including CCR units, located above a mounded groundwater table;
- Waste management units, including CCR units, located above aquifers with seasonally variable groundwater flow directions;
- Waste management units, including CCR units, located in areas where nearby surface water features or tidally influenced surface water bodies may influence groundwater levels or expected flow directions;
- Waste management units, including CCR units, located near intermittently or continuously used groundwater production wells; and/or
- Waste management units, including CCR units, located in karst (carbonate bedrock) or faulted areas where subsurface geologic features may modify expected groundwater flow paths.

Based on the available hydrogeologic information for the Station, other than the considerations listed below, Dominion Energy is not aware of any special conditions, including those listed above, that would affect the design of a downgradient groundwater monitoring network that can effectively monitor the uppermost aquifer:

- Nearby residential properties may operate water supply wells that are screened in the uppermost aquifer. The operation of these wells is not expected to adversely impact Dominion Energy's ability to monitor groundwater beneath the CCR impoundments with a conventional groundwater monitoring network. This determination is based on the distance between the residential structures and the CCR ponds, the presence of a hydrologic divide between the Station and the residential structures, and the minimal expected groundwater extraction rate for residential wells (*i.e.*, limited cones of depression).

- Tidal fluctuations are observed in wells that are screened in the uppermost aquifer near the shoreline of Quantico Creek. These tidal fluctuations are not expected to adversely impact Dominion Energy's ability to effectively monitor groundwater in the uppermost aquifer using a conventional groundwater monitoring network. This determination is based on the relatively steep gradient that is present in the uppermost aquifer, such that flow reversals associated with tidal fluctuations are not expected to impact upgradient/background wells.

4.2 Monitoring Well Placement

The monitoring networks described herein are designed to meet the performance standards specified in the VSWMR and the CCR Rule, and will be protective of human health and the environment. Accordingly, the monitoring networks are designed so that adequate monitoring coverage is provided to represent the quality of groundwater upgradient and downgradient of the existing and former CCR units. A summary of survey information for the monitoring wells is provided in Table 1. Drawing 11 shows the hydraulic locations of the compliance wells relative to the CCR units.

4.2.1 Ponds A, B, and C Compliance Monitoring Network

Based on the contiguous spatial relationship of former Ponds A, B, and C, these three former CCR ponds will be monitored as one unit for the groundwater closure determination. As presented in the following sections, the compliance monitoring network for former Ponds A, B, and C includes one background well and four downgradient wells including one proposed within the former impoundment (ABC-1615) that are screened within the uppermost aquifer beneath former Ponds A, B, and C.

4.2.1.1 Ponds A, B, and C Background Compliance Well

The compliance monitoring network for former Ponds A, B, and C includes one background well as follows:

ABC-1602

As shown on Drawing 11, monitoring well ABC-1602 is located hydraulically upgradient from the former CCR units. A summary of the well construction information for ABC-1602 is provided in Table 1.

4.2.1.2 Ponds A, B, and C Downgradient Compliance Wells

The compliance monitoring network for former Ponds A, B, and C includes three downgradient wells as follows:

ABC-1607	ABC-1608	ABC-1614

As shown on Drawing 11, the downgradient compliance wells are located hydraulically downgradient from the former CCR units in close proximity to the former downgradient waste unit boundary. A summary of the well construction information for downgradient compliance wells is provided in Table 1.

4.2.1.3 Ponds A, B, and C Pond Closure Demonstration Well

The compliance monitoring network for former Ponds A, B, and C includes one pond footprint well as follows:

ABC-1615 (proposed)

As shown on Drawing 11, the proposed pond footprint well is located within the former CCR unit beneath the waste unit boundary. A summary of the proposed well construction information for the pond footprint well is provided in Table 1.

4.2.2 Pond D Compliance Monitoring Network

As presented in the following sections, the compliance monitoring network for Pond D includes two background wells and six downgradient wells that are screened within the uppermost aquifer beneath Pond D.

4.2.2.1 Pond D Background Compliance Wells

The compliance monitoring network for Pond D includes two background wells as follows:

ED-1612	ED-24R

As shown on Drawing 11, monitoring well ED-1612 is located hydraulically upgradient from Pond D. Background well ED-24R is located downgradient from ED-1612 in a location that is not expected to be impacted by a release from Pond D. Well ED-24R is included in the background network for Pond D to account for spatial variability of the geochemistry within the uppermost aquifer beneath Pond D. A summary of the well construction information for the background wells is provided in Table 1.

4.2.2.2 Pond D Downgradient CCR Compliance Wells

The compliance monitoring network for Pond D includes six downgradient wells as follows:

ED-1D	ED-9R2	SD-1603
SD-1604	ED-1605	ED-1606

As shown on Drawing 11, the downgradient compliance wells are located hydraulically downgradient from the CCR unit in close proximity to the downgradient waste unit boundary. A summary of the well construction information for downgradient compliance wells is provided in Table 1.

4.2.2.3 Pond D Downgradient VSWMR Sentinel Wells

In addition to the CCR compliance wells, Pond D will be monitored with two sentinel wells, as follows:

SD-1610 (proposed)	SD-1611D

The proposed location of sentinel well SD-1610 is shown on Drawing 11. Due to its location in a potential construction area, the proposed location of groundwater monitoring well SD-1610 will depend on the final closure determination for Pond D. Once the Pond D closure determination has been finalized, SD-1610 will be scheduled for installation. Sentinel well SD-1611D has been installed. Details for construction of SD-1611D are presented in Table 1. Background sampling will not be required for the sentinel wells; rather, these well will be sampled semi-annually with the compliance wells.

4.2.2.4 Closure Demonstration Well

In addition to the CCR compliance wells, Pond D will be monitored by a closure demonstration well to be installed inside the limits of the former pond. The proposed well will be installed as closure activities allow.

ED-2000 (proposed)

4.2.3 Pond E Compliance Network

As presented in the following sections, the compliance monitoring network for former Pond E includes two background wells and six downgradient wells including one proposed within the former impoundment (ED-25) that are screened within the uppermost aquifer beneath Pond E.

4.2.3.1 Pond E Background Compliance Wells

The compliance monitoring network for former Pond E includes two background wells as follows:

ED-24R	ED-26

As shown on Drawing 11, monitoring well ED-26 is located hydraulically upgradient from former Pond E on the north side of the former pond. Background well ED-24R is located along the northern side of the Station property in a hydraulic location that is not expected to be impacted by a release from any of the CCR ponds.

Monitoring well ED-24R is included in the background network for Pond E to account for spatial variability within the uppermost aquifer beneath Pond E. A summary of the well construction information for the background wells is provided in Table 1.

4.2.3.2 Pond E Downgradient Compliance Wells

The compliance monitoring network for former Pond E includes five downgradient wells as follows:

ES-3D	ES-1609	ES-1613
T-1615D	T-1615S	--

As shown on Drawing 11, the downgradient compliance wells are located hydraulically downgradient from the former CCR unit in close proximity to the downgradient waste unit boundary. A summary of the well construction information for downgradient compliance wells is provided in Table 1.

4.2.3.3 Pond E Pond Closure Demonstration Well

The compliance monitoring network for former Pond E includes one pond footprint well as follows:

ES-25 (proposed)

As shown on Drawing 11, the proposed pond footprint well is located within the former CCR unit beneath the waste unit boundary. A summary of the proposed well construction information for the pond footprint well is provided in Table 1.

4.2.4 Other Site VSWMR Sentinel Wells

In addition to the CCR compliance wells, the site will be monitored with two additional sentinel wells once the DEQ issues a solid waste permit, as follows:

ED-22RA	ED-23R

Both sentinel wells are existing wells. Details for construction of the wells is presented in Table 1. Background sampling will not be required for the sentinel wells; rather, these well will be sampled semi-annually with the compliance wells.

4.2.5 Vertical Placement

All monitoring wells have been drilled and completed to monitor the uppermost aquifer.

4.2.6 Screen Interval Placement

Monitoring well screen lengths are summarized in Table 1. As presented, the wells were designed and constructed with between 5 and 20 feet of screen to provide representative groundwater samples from the water-bearing portion of the uppermost aquifer underlying the CCR impoundments. In general, the wells are constructed so that the top of the screen is located beneath the seasonal low water table, and where practical, beneath the bottom of the adjoining CCR impoundment.

4.3 Monitoring Well Construction

Boring and well construction logs for the compliance monitoring network wells are presented in Appendix A. The monitoring wells, with the exception of ED-9R2 and ED-24R were installed in late 2016 with either 2.0-inch or 2.5-inch diameter polyvinyl chloride (PVC) and 0.010 slot well screen. Monitoring well ED-9R2 was installed in November 2002 and ED-24R was installed in September 2006.

The monitoring wells were drilled using hollow-stem auger and/or air rotary equipment. It is anticipated that future wells will be constructed using the hollow-stem auger, sonic or other similar industry-accepted method with wells constructed in general accordance with the procedures outlined herein and in the USEPA Technical Enforcement Guidance Document (USEPA, 1986).

4.3.1 Drilling Methods

Drilling new monitoring wells and/or observation wells, if necessary, will be performed in general accordance with the specifications presented in Appendix B, and are expected to use hollow-stem auger methods or a similar industry-accepted method. A qualified groundwater scientist will prepare a boring and well construction log for each new well. Dominion Energy will transmit the boring logs, well construction logs, and appropriate maps for any wells to be included in the permitted network to the DEQ within 14 days of certification (no more than 44 days from the completion of well construction activities, to include a survey by a licensed surveyor) by the qualified groundwater scientist in accordance with the VSWMR. Available boring logs and well construction diagrams for the existing on-site monitoring wells are provided in Appendix A.

4.3.2 Well Screens

Monitoring well screens should, in most circumstances, be 10 feet in length. The design of new monitoring wells should take into consideration the hydrogeologic conditions at the site, the fate and transport considerations of the potential contaminants being monitored, and the procedure(s) being used to sample the monitoring well(s). Ideally, to preserve the geochemical integrity of the water samples, well screens should be designed and placed (vertically) in a manner that prevents a change in the well screen exposure during sampling (relative to the exposure between sampling events) so that conditions during the sampling event do not change from the conditions that are present between sampling events. For CCR facilities,

DEQ requires that all monitoring wells be screened solely within the saturated zone of the uppermost aquifer (no portion of the screen should be exposed above the zone of saturation). In addition, wells shall be screened in naturally occurring geologic formations, not in manmade deposits (*i.e.*, fill, mine spoils).

4.3.3 Wellhead Completions

Wells will be completed with a locking protective standpipe and a concrete apron for surface protection. Construction of new monitoring wells will be performed in general accordance with the specifications presented in Appendix B. Protective bollards for monitoring wells will be installed at the time of well construction as needed for wells located adjacent to high traffic areas, or at a later date if it is determined that protective bollards are warranted. Bollards will generally be painted with high-visibility paint to assist with wellhead protection.

4.3.4 Well Development

Newly constructed wells will be developed to remove particulates that are present in the well casing, filter pack, and adjacent aquifer matrix due to construction activities. Development of new monitoring wells will be performed at least 24 hours after well construction. Wells may be developed with disposable PVC bailers, a well development pump, or other approved method. Well development procedures are presented in Appendix B.

Samples withdrawn from the monitoring wells should be clay- and silt-free; therefore, wells may require redevelopment from time to time based upon observed turbidity levels during sampling activities, and/or measurements of total depth over time that indicate sediment accumulation. If redevelopment of a monitoring well is required, it will be performed and documented in a manner similar to that used for a new well.

4.3.5 Pump Installations

Wells designated for use in the compliance monitoring network have dedicated bladder pumps, or similar pumps, installed to facilitate micropurge sampling activities. The pumps and associated tubing are constructed of environment-inert materials suitable for use in compliance monitoring programs. Each pump should be placed within the middle portion of the well screen, and no closer than 2 feet from the bottom of the well.

4.3.6 Documentation

Documentation of future well construction activities will be in accordance with the VSWMR and CCR Rule. New wells will be surveyed by a licensed surveyor to within ±0.05 foot on the horizontal plane and ±0.01 foot vertically in reference to mean sea level. A boring log, well construction log, groundwater monitoring network map, and installation certification will be submitted to the DEQ within 14 days of certification by the

qualified groundwater scientist in accordance with the VSWMR. Separately, a copy of the boring log, well construction log, groundwater monitoring network map, and installation certification will be incorporated into the Station's operating record as required under §257.105 of the CCR Rule as adopted in the VSWMR. The certification shall occur within 30 days of well construction (including the licensed well survey).

4.4 Monitoring Well Decommissioning Procedures

If a monitoring well becomes unusable during the life of the monitoring program, Dominion Energy will make reasonable attempts to decommission the monitoring well in accordance with procedures presented in Appendix B. Consistent with Permit condition X1.B.2.e, no wells onsite will be decommissioned without prior approval from DEQ.

4.4.1 Documentation

DEQ approval will be obtained prior to decommissioning any monitoring wells that are in the Station's compliance monitoring network. A report describing the decommissioning procedures will be transmitted to DEQ following completion of the decommissioning activities. Separately, a copy of the report will be included in the Station's operating record in accordance with the recordkeeping requirements of §257.105 as adopted in the VSWMR.

4.5 Monitoring Well Replacement

Any monitoring well that fails to perform as designed shall be replaced prior to the next regularly scheduled groundwater sampling event, or as warranted. Non-performance of permitted groundwater monitoring wells should be reported to DEQ within 30 days of recognition.

If a monitoring well becomes unusable during the life of the monitoring program, Dominion Energy will make reasonable attempts to decommission the monitoring well in accordance with the procedures presented in Appendix B.

4.5.1 Documentation

DEQ approval will be obtained prior to decommissioning any monitoring wells that are in the compliance monitoring network. A report describing the decommissioning procedures will be transmitted to DEQ following completion of the decommissioning activities. The report will be prepared in accordance with the provisions in Appendix B.

4.6 Well Operations and Maintenance

In accordance with the VSWMR and §257.91(e)(2), the compliance monitoring wells will be operated and maintained so they perform to their design specifications throughout the life of the monitoring program. Maintenance activities for the compliance wells are as follows:

Activity	Schedule
Lock Inspection	Each Monitoring Event
Protective Casing Inspection	Each Monitoring Event
Pump Inspection & Cleaning	Annually as needed
Depth to Well Bottom	Annually as needed
Concrete Pad Inspection	Each Monitoring Event
Surface Water Infiltration Evaluation	Each Monitoring Event
Grass Mowing	As Needed

The results from the well inspections will be recorded on a Well Inspection Log during the routine semi-annual sampling events. A sample of a typical well inspection log is presented in Appendix B.

5.0 GROUNDWATER MONITORING PROGRAM

This GWMP is intended to provide a framework for consistent sampling and analysis procedures (as provided in Section 6.0) that are designed to ensure monitoring results provide an accurate representation of groundwater quality at the background and downgradient wells.

Groundwater monitoring activities for Ponds D and E have historically been performed in compliance with two regulatory programs:

1. Virginia Pollutant Discharge Elimination System (VPDES) Permit No. VA0002071 – Groundwater monitoring and reporting activities are currently being conducted in accordance with the conditions in the Possum Point Power Station VPDES Permit and the affiliated VPDES GWMP.

2. CCR Rule – Groundwater monitoring for the Pond D began in November 2016 under the Detection Monitoring Program which included eight background sampling events and the initial Detection Monitoring Program event which was conducted in September 2017. Evaluation of Detection Monitoring Program data identified statistically significant increases (SSIs) over background for several CCR Rule Appendix III constituents. The SSI determination was completed in February 2018. Based on the SSI findings, Dominion Energy initiated the Assessment Monitoring Program with the initial Assessment Monitoring Program sampling event conducted in March 2018.

CCR Rule - Groundwater monitoring for the Ponds A, B, C, and E which are inactive CCR impoundments, began in November 2016 under the Detection Monitoring Program. The initial modified Detection Monitoring Program event for these ponds was completed (analysis included) by April 17, 2019.

To comply with the requirements of the CCR Rule, as well as Solid Waste Facility Permit Number 617, Dominion Energy has prepared this GWMP which presents a “modified” program modeled on the requirements of the CCR Rule and the VSWMR and as directed by DEQ. The modified Detection Monitoring Program is designed to meet the requirements of VSWMR’s First Determination Monitoring Program and CCR’s Detection Monitoring Program. The modified Assessment Monitoring Program is designed to meet the requirements of VSWMR’s Phase II Monitoring Program and CCR’s Assessment Monitoring Program. To the extent a conflict exists between the requirements of the CCR Rule and VSWMR, this GWMP utilizes the more stringent of requirements. Current monitoring programs for all ponds have transitioned to the modified Assessment Monitoring Program.

Records of the background groundwater quality data and subsequent measurements, including concentration data, will be kept in the operating record, provided to DEQ, and placed on the publicly available website in accordance with the recordkeeping and notification requirements of §257.105,

§257.106, and §257.107 as adopted in the VSWMR. These records will be maintained throughout the active lives and post-closure care periods for the impoundments.

For each parameter, the laboratory certificates-of-analysis will identify the analytical Limit of Quantitation (LOQ), the analytical Limit of Detection (LOD), the reported concentration, and applicable laboratory quality assurance/quality control (QA/QC) data on surrogate and standards analyses. Statistical evaluations of the analytical data (if completed), GWPS comparisons, static water level determinations and evaluations, and use of other measurement, sampling, and analytical devices, will be retained throughout the active lives and post-closure care periods for the ponds.

Details for the Modified Detection and Assessment Monitoring Programs are presented in the following sections.

5.1 Modified Detection Monitoring Program

The former Ash Ponds A, B, C, and E and Ash Pond D are currently monitored under the modified Assessment Monitoring Program. Details regarding the modified Detection Monitoring Program are presented herein in the event that one or more of the ponds meets the requirements for monitoring under the modified Detection Monitoring Program at a future time. Note that future implementation of the Modified Detection Monitoring Program would require the owner to complete a major permit modification.

The modified Detection Monitoring Program is designed to identify the presence and concentration of targeted potential CCR and solid waste constituents in the uppermost aquifer beneath the ponds. Components of the modified Detection Monitoring Program, including analytical requirements, sampling frequency, and data evaluation, are discussed in the following sections.

5.1.1 Constituents

The modified Detection Monitoring Program will include sampling and analysis of the inorganic constituents (metals) listed in Table 3.1 Column A of the VSWMR, Appendix III of the CCR Rule, selected VPDES constituents and parameters (alkalinity, iron, manganese, hardness, sodium, and total organic carbon), as well as a hexavalent chromium (DEQ requested). Samples will be analyzed using the appropriate analytical method from the latest edition of USEPA *Test Methods for Evaluating Solid Waste - Physical/Chemical Methods, SW-846* (USEPA, 2015), if available. Suggested analytical methods and Practical Quantitation Limits (PQL) are presented in Table 2.

5.1.2 Background Sampling

The ponds have fulfilled the background sampling requirements for the CCR Rule; however, if additional background sampling is required for new wells or to establish updated background groundwater quality for a new constituent, background sampling will be necessary. VSWMR and the CCR Rule differ in the

minimum number of independent samples required to establish background; as a result, the more stringent of the regulatory requirements will be followed. Therefore, a minimum of eight independent background samples for monitored constituents and parameters will be collected from each background and downgradient well for the modified Detection Monitoring Program. The background sampling events will be performed on a temporal schedule (if feasible) that accounts for both seasonal and spatial variability in groundwater quality for the constituents listed in Tables 2 and 3. The results of background sampling will be presented in a Facility Background Monitoring Report as described in Section 5.2.6.1.

5.1.3 Sampling Schedule

After establishing background concentrations for the impoundments, the modified Detection Monitoring Program sampling schedule will be based on a semi-annual schedule (once every 180 days plus or minus 30 days) with the sample analyses completed within the calendar year semi-annual period consistent with the CCR Rule.

5.1.4 Verification Sampling Events

If verification sampling events are undertaken to verify suspect analytical results, the verification sampling activities, including laboratory analyses, must be completed within the combined 30-day determination and 14-day reporting window for reporting statistical exceedances (total of 44 days from the date of receipt of the laboratory certificates of analysis for the sampling event).

5.1.5 Analytical Data Evaluation

VSWMR and the CCR Rule differ in the required evaluation period after the receipt of laboratory analytical results; as a result, the more stringent of the regulatory requirements will be followed. Therefore, within 30 days of receiving the laboratory analytical results, the groundwater data will be evaluated statistically as described in Section 7.0 of this GWMP. In accordance with 9VAC20-81-250.A.4.j, voluntary third-party data validation of laboratory data may also be completed during the 30-day statistical determination period.

The results of the statistical analyses will then be evaluated as follows:

- Provided that there are no statistically significant detections over the pond background concentrations, the modified Detection Monitoring Program will continue on a semi-annual schedule with the results of the statistical analyses presented in the semi-annual and annual reports prepared for the pond.
- If one or more monitored constituents are detected at statistically significant concentrations over the pond background concentrations the Dominion Energy shall within 14 days of this finding notify the DEQ of its intention to:
  - Implement the modified Assessment Monitoring Program; or
  - Prepare and submit an ASD to the DEQ and obtain DEQ's approval of said ASD within 90 days unless a longer timeframe is granted by DEQ.

5.1.6 Reporting

Dominion Energy will comply with the requirements of the CCR Rule and VSWMR for data collection, storage, and reporting including:

- Recordkeeping requirements specified in 40 CFR 257.105(h);
- Recordkeeping requirements specified in 9VAC20-81-250.E.1;
- Reporting requirements specified in 9VAC20-81-250.E.2;
- Notification requirements specified in 40 CFR 257.106(h); and
- Publicly accessible Internet site requirements specified in 40 CFR 257.107(h).

Reports required under the modified Detection Monitoring Program include statistical exceedance notifications, if required; semi-annual reports; annual reports; and a Facility Background Determination Report. The minimum required information for each report and submittal timeframes for the reports are discussed in the following sections.

5.1.6.1 Statistical Exceedance Notification

In the event that one or more constituents are detected at a statistically significant concentration relative to the pond's background concentrations, Dominion Energy is required to notify the DEQ within 14 days of this determination. The notification shall identify the pond, the constituent exceeding the background concentration, the well identification, and the owner's/operator's intent to either initiate a modified Assessment Monitoring Program for that pond or to submit and obtain DEQ approval of an ASD.

5.1.6.2 Semi-Annual Report

For each pond, no later than 120 days of completing the first semi-annual event of each year (*i.e.*, after receiving the laboratory analytical results), Dominion Energy will submit a semi-annual report to DEQ. Each semi-annual report will include the following:

- Signature page signed by a professional geologist or qualified groundwater scientist;
- Impoundment name and permit number;
- Statement noting whether or not all monitoring points within the permitted network for the pond installed to meet the requirements of the VSWMR were sampled as required during the event;
- Calculated rate of groundwater flow during the sampling period;
- The groundwater flow direction as determined during the sampling period presented as either plain text or graphically as a potentiometric surface map;
- Statement noting whether or not there were SSIs over background during the sampling period, the supporting statistical calculations, and reference to the date the director was notified of the increase pursuant to timeframes in the VSWMR, if applicable;

- Copy of the full Laboratory Analytical Report including dated signature page (laboratory manager or representative) to demonstrate compliance with the VSWMR timeframes. The DEQ will accept the lab report in CD-ROM format; and
- A brief discussion of the sampling and analysis activities.

5.1.6.3 Annual Report

For each impoundment Dominion Energy will prepare an annual report for submission to the DEQ no later than January 31st of each year pursuant to §257.90.e of the CCR Rule or 120 days from the date the second semi-annual sampling and analysis activities are complete pursuant to 9VAC20-81-250.E.2 of the VSWMR, whichever occurs first. The annual report will include the following:

- A signature page;
- A completed QA/QC DEQ Form ARSC-01.
- The pond's name, type, permit number, current owner or operator, and location keyed to a United States Geological Survey (USGS) topographic map;
- Summary of the design type, operational history, and size (acres) of the pond, including key dates such as beginning, and termination of waste disposal actions and dates different groundwater monitoring phases were entered;
- Description of the surrounding land use noting whether any adjoining land owners utilize private wells as a potable water source;
- A discussion of the topographic, geologic, and hydrologic setting of the pond including a discussion on the nature of the uppermost aquifer (*i.e.*, confined versus unconfined) and proximity to surface waters;
- A discussion of the monitoring wells network noting any modifications that were made to the network during the year or any nonperformance issues and a statement noting that the monitoring well network meets (or did not meet) the VSWMR performance requirements;
- A listing of the groundwater sampling events undertaken during the previous calendar year;
- A historical table listing the detected constituents, and their concentrations identified in each well during the sampling period; and
- Evaluations of and appropriate responses to the groundwater elevation data; groundwater flow rate as calculated using the prior year's elevation data; groundwater flow direction (as illustrated on a potentiometric surface map); and sampling and analytical data obtained during the past calendar year.

In addition to the above requirements, Dominion Energy must comply with the CCR Rule recordkeeping requirements specified in §257.105(h)(1), the notification requirements specified in §257.106(h)(1), and the internet requirements specified in §257.107(h)(1).

5.1.6.4 Alternate Source Demonstration

Dominion Energy may demonstrate that a source other than the pond caused the contamination, or that a statistically significant detection resulted from an error in sampling procedures, analysis, statistical procedures, or natural variation in groundwater quality. The ASD must be submitted to and approved by

the DEQ within 90 days of confirming the statistical exceedance to avoid advancing into the modified Assessment Monitoring Program.

If the ASD is approved by the DEQ, the operator may continue with the modified Detection Monitoring Program. If the ASD is not approved by the DEQ, the operator will initiate the modified Assessment Monitoring Program within 90 days of the statistically significant detection.

5.1.6.5 Well Installation Report

Well installation reports as may be required shall be submitted to the DEQ within 44 days of well completion (including the licensed survey). The well installation reports shall include permit-required information and shall be certified by a qualified groundwater scientist. After installation is complete, eight background samples will be collected.

5.1.6.6 Well Decommissioning Report

Well decommissioning reports as may be required shall be submitted to the DEQ within 44 days of completing the physical well decommissioning activities. The well decommissioning reports shall include permit-required information and shall be certified by a qualified groundwater scientist.

5.1.6.7 Well Non-performance Notification

Well non-performance reports as may be required shall be submitted to the DEQ within 30 days of recognizing the non-performance issue.

5.2 Modified Assessment Monitoring Program

The modified Assessment Monitoring Program is designed to identify the presence and concentration of targeted potential CCR constituents in the uppermost aquifer beneath the CCR unit, and to determine if those constituents are derived from the CCR unit at concentrations that would require groundwater corrective action. Currently, Ponds A, B, C, D, and E are monitored under the modified Assessment Monitoring Program.

In accordance with the CCR Rule as adopted in the VSWMR, a notification must be prepared and placed in the Station's operating record and on the publicly available website stating that a modified Assessment Monitoring Program has been established. Pursuant to §257.106 as adopted in the VSWMR, the DEQ must be notified when the notice has been placed.

As requested by the DEQ, Dominion Energy will establish a background concentration for the constituents in the modified Assessment Monitoring Program. The background concentrations will be submitted to the DEQ as a Facility Background Determination Report.

Components of the modified Assessment Monitoring Program, including analytical requirements, sampling frequency, and data evaluation, are discussed in the following sections.

5.2.1 Constituents

The modified Assessment Monitoring Program will consist of the following constituents:

- CCR Rule Appendix III constituents;
- CCR Rule Appendix IV constituents (annual event with semi-annual events for detected constituents);
- VSWMR Table 3.1 Column B metals not included in the CCR Rule;
- VPDES Parameters hardness, iron, manganese, phenolics, potassium, sodium, and total organic carbon; and
- Speciation of chromium (hexavalent).

Samples will be analyzed using the appropriate analytical method from the latest edition of USEPA *Test Methods for Evaluating Solid Waste - Physical/Chemical Methods, SW-846,* if available. The suggested analytical methods and PQL for the proposed modified Assessment Monitoring Program constituents are presented in Table 3. Final laboratory results will be reported in parts per billion for all metals constituents.

5.2.2 Sampling Schedule

Sampling under the modified Assessment Monitoring Program will occur semi-annually (180 days plus or minus 30 days) with the sample analyses completed within the calendar year semi-annual period consistent with the CCR Rule.

5.2.3 Verification Sampling Events

If verification sampling events are undertaken to verify suspect analytical results, the verification sampling activities, including laboratory analyses, must be completed within the combined 30-day determination and 14-day reporting window for GWPS exceedances (total of 44 days from the date of receipt of the laboratory certificates of analysis for the sampling event).

5.2.4 Establishing Groundwater Protection Standards

Ash-pond-specific GWPS will be calculated using recent data for CCR Appendix IV constituents, VSWMR Table 3.1 Column B constituents, and boron. GWPS will be established in accordance with §257.95(h) as adopted in the VSWMR. The proposed GWPS will be developed based on the following requirements unless the requirements for establishing GWPS are revised by the USEPA with future revisions to the CCR Rule, in which case the CCR Rule provisions will supersede these provisions:

- For constituents for which a USEPA Maximum Contaminant Level (MCL) has been established, the MCL for that constituent will be used as GWPS;

- For constituents for which MCLs have not been established, the ash-pond-specific background concentration established from the background wells will be used as GWPS; or
- For constituents for which the pond-specific background level is higher than the MCL, the background concentration established from the background wells will be used as GWPS, as approved by the DEQ.

The established GWPS will be included in the annual monitoring report required by §257.90(e) as adopted by the VSWMR and the corrective action report (if required). The MCL-based GWPS will be updated upon USEPA's promulgation of new or revised MCLs. Following approval, the background-based GWPS will be updated every two years such that the eight most recent background well sampling results will replace the oldest eight background well sampling results.

Following initiation of the modified Assessment Monitoring Program and the establishment of background concentrations for the Table 3 constituents to be presented to the DEQ in a Facility Background Report, proposed GWPS for the applicable constituents (CCR Rule Appendix IV constituents and VSWMR Table 3.1 Column B constituents) will be submitted to the DEQ consistent with the VSWMR and the CCR Rule. The GWPS based on MCLs will become effective immediately upon proposal. The GWPS based on background concentrations will become effective upon written DEQ approval. A table of the approved GWPS will be placed in the facility's operating record.

5.2.5 Analytical Data Evaluation

Groundwater data will be evaluated statistically as described in Section 7.0 of this GWMP. The results of the statistical analyses will then be evaluated as follows:

- If the concentration of any monitored constituent is present in the groundwater at a concentration that is above the pond-specific background concentration, but below the current GWPS, Dominion Energy shall continue the modified Assessment Monitoring Program.
- If any monitored constituent is present at a concentration that exceeds the pond-specific background concentration and/or the most current established GWPS, Dominion Energy may:
  - Submit an ASD certified by a qualified professional engineer within 90 days of determining the exceedance of GWPS; or
  - Begin the initial steps toward groundwater Corrective Action. The Corrective Action Program will be consistent with both VSWMR 9VAC20-81-260 and §257.96, §257.97, and §257.98 of the CCR Rule.

5.2.6 Data Validation

In accordance with 9VAC20-81-250.A.4.j, voluntary third-party data validation of laboratory data may be completed during the 30-day statistical determination period.

5.2.7 Reporting

Dominion Energy will comply with the requirements of the CCR Rule and VSWMR for data collection, storage, and reporting including:

- Recordkeeping requirements specified in 40 CFR 257.105(h);
- Recordkeeping requirements specified in 9VAC20-81-250.E.1;
- Reporting requirements specified in 9VAC20-81-250.E.2;
- Notification requirements specified in 40 CFR 257.106(h); and
- Publicly accessible Internet site requirements specified in 40 CFR 257.107(h).

Reports required under the modified Assessment Monitoring Program include a GWPS exceedance notification (if required), a semi-annual report, and an annual report. Consistent with the CCR Rule reporting requirements, required reports will be provided to the DEQ Regional Office upon posting in the ash-pond's operating record and publicly-accessible web site.

The minimum required information for each report and submittal timeframes for the reports are discussed in the following sections.

5.2.7.1 Facility Background Report

A Facility Background Report will be prepared for the pond following the initiation of the modified Assessment Monitoring Program. The Facility Background Report will present the pond's established background concentrations for the constituents listed in Table 3. The Facility Background Determination Report will be placed in the operating record within 30 days of establishing or re-establishing unit-specific background concentrations.

5.2.7.2 Groundwater Protection Standard Exceedance Notifications

Consistent with §257.93(h)(2) of the CCR Rule and 9VAC20-81-250.C.3.e(3)(a) of the VSWMR, Dominion Energy will submit a GWPS exceedance notification for Table 3 constituents that have established GWPS to the DEQ within 14 days of identifying a statistical exceedance of a GWPS (44 days of issuance of the laboratory report).

The notification shall identify the constituent exceeding the GWPS, the pond, the well identification, and the owner's/operator's intent to either initiate a Corrective Action Program and proceed with a Nature and Extent Study and Assessment of Corrective Measures within 90 days of noting the GWPS exceedance, or to submit and obtain DEQ approval of an ASD.

5.2.7.3 Semi-Annual Report

No later than 120 days of completing the first semi-annual event of each year (*i.e.*, after receiving the laboratory analytical results), Dominion Energy will submit a semi-annual report for each impoundment to DEQ. Each semi-annual report will include the following:

- Signature page signed by a professional geologist or qualified groundwater scientist;
- Pond name and permit number;
- Statement noting whether or not all monitoring points within the permitted network installed to meet the requirements of the VSWMR were sampled as required during the event;
- Calculated rate of groundwater flow during the sampling period;
- The groundwater flow direction as determined during the sampling period presented as either plain text or graphically as a potentiometric surface map;
- Statement noting whether or not there were SSIs over background during the sampling period, the supporting statistical calculations, and reference to the date the director was notified of the increase pursuant to timeframes in the VSWMR, if applicable;
- Copy of the full Laboratory Analytical Report including dated signature page (laboratory manager or representative) to demonstrate compliance with the VSWMR timeframes. The DEQ will accept the lab report in CD-ROM format; and
- A brief discussion of the sampling and analysis activities.

5.2.7.4 Annual Report

Annual reports for each impoundment will be prepared and submitted to DEQ no later than 120 days after completing the second semi-annual event of each year (*i.e*., after receiving the laboratory analytical results) or no later than January 31st of the following calendar year. The annual reports will include the following:

- A signature page;
- A completed QA/QC DEQ Form ARSC-01.
- The pond's name, type, permit number, current owner or operator, and location keyed to a United States Geological Survey (USGS) topographic map;
- Summary of the design type, operational history (*i.e.*, trench fill versus area fill), and size (acres) of the pond including key dates such as beginning, and termination of waste disposal actions and dates different groundwater monitoring phases were entered;
- Description of the surrounding land use noting whether any adjoining land owners utilize private wells as a potable water source;
- A discussion of the topographic, geologic, and hydrologic setting of the pond including a discussion on the nature of the uppermost aquifer (*i.e.*, confined versus unconfined) and proximity to surface waters;
- A discussion of the monitoring wells network noting any modifications that were made to the network during the year or any nonperformance issues and a statement noting that the monitoring well network meets (or did not meet) the VSWMR performance requirements;
- A listing of the groundwater sampling events undertaken during the previous calendar year;

- A historical table listing the detected constituents, and their concentrations identified in each well during the sampling period; and
- Evaluations of and appropriate responses to the groundwater elevation data; groundwater flow rate as calculated using the prior year's elevation data; groundwater flow direction (as illustrated on a potentiometric surface map); and sampling and analytical data obtained during the past calendar year.

In addition to the above requirements, Dominion Energy must comply with the CCR Rule recordkeeping requirements specified in §257.105(h)(1), the notification requirements specified in §257.106(h)(1), and the internet requirements specified in §257.107(h)(1).

5.2.7.5 Alternate Source Demonstration

Dominion Energy may demonstrate that a source other than the pond caused a statistically significant detection of one or more monitored constituents or statistical exceedances of a GWPS, or that the statistical increase resulted from an error in sampling procedures, analysis, statistical procedures, or natural variation in groundwater quality. The ASD must be submitted to the DEQ within 90 days of the sampling event from which the exceedance originated.

If an ASD associated with a GWPS exceedance is approved by the DEQ, Dominion Energy may continue with the modified Assessment Monitoring Program. If such an ASD is not approved by the DEQ, Dominion Energy must initiate an Assessment of Corrective Measures and a Corrective Action Program.

5.2.7.6 Well Installation Report

Well installation reports (for new wells) as may be required shall be submitted to the DEQ within 44 days of well completion (including the licensed survey). The well installation reports shall include permit-required information and shall be certified by a qualified groundwater scientist. After installation is complete, eight background samples will be collected.

5.2.7.7 Well Decommissioning Report

Well decommissioning reports as may be required shall be submitted to the DEQ within 44 days of completing the physical well decommissioning activities. The well decommissioning reports shall include permit-required information and shall be certified by a qualified groundwater scientist.

5.2.7.8 Well Non-performance Notification

Well non-performance reports as may be required shall be submitted to the DEQ within 30 days of recognizing the non-performance issue.

5.2.7.9 Modified Detection Monitoring Program Reversion Notification

Consistent with §257.95(e) as adopted in the VSWMR, if there are no SSIs over background concentrations for two consecutive monitoring events, Dominion Energy may revert the groundwater monitoring program

to the modified Detection Monitoring Program with DEQ approval. This reversion shall be documented in a notification submitted to the DEQ before the next compliance monitoring event.

5.2.7.10 Groundwater Protection Standard Update Notifications

Notifications for GWPS updates due to changes in USEPA MCLs and/or impoundment-specific background concentrations shall be submitted to the DEQ within 30 days of the update.

5.2.7.11 Off-site Plume Notification

In the event that a groundwater plume (concentrations above GWPS) is determined to extend off site onto adjacent downgradient property based on corrective action characterization activities, Dominion Energy will notify the DEQ and the affected landowner within 15 days of the determination consistent with Permit condition XI.K.3.

6.0 SAMPLE AND ANALYSIS PROGRAM

Proper sampling procedures are an important and fundamental aspect in an effective monitoring program. The following sections, which are consistent with USEPA guidance and the requirements of the CCR Rule, outline the proposed sample collection procedures.

6.1 Sampling Order

The existing compliance wells are equipped with dedicated purging and sampling equipment; therefore, the likelihood of cross-contamination during sampling is minimized. Accordingly, the anticipated sampling order will follow a sequence based on consideration of field conditions at the time of sampling.

6.2 Water Level Gauging

Prior to purging each monitoring well, the static water level will be gauged using an electronic water level indicator accurate to 0.01 foot. The measurement will be obtained from the surveyed measuring point on each well.

Prior to initial use and between wells, the portion of the water level indicator that comes in contact with the groundwater in the well will be decontaminated to avoid cross-contamination between monitoring wells. In addition to decontaminating the downhole equipment, sampling personnel will don new gloves between wells, and more frequently as needed, to avoid cross-contamination between monitoring wells.

6.3 Purging Procedure

The monitoring wells in the monitoring network will be purged and sampled using a micropurge technique. Micropurge sampling can greatly reduce the volume of water that must be purged from a well before representative samples can be collected, and typically provides for the collection of more representative samples than do other purge methods, resulting in more consistency in analytical results. Micropurging is accomplished through the use of dedicated low-flow sampling devices. Bailers and portable pumps are not recommended because they cause mixing of the standing water column within the well (Robin and Gilham, 1987). This mixing action requires the removal of the traditional large purge volumes before sampling. Introducing any device into the well prior to sampling causes a surging effect that may increase turbidity and interfere with the normal flow of water through the well screen. This disturbance may remain in effect for as long as 24 to 48 hours (Kearl *et al.*, 1992).

For monitoring wells with dedicated bladder pumps equipped with check values that hold stagnant water in the discharge tubing between sampling events, the discharge tubing shall be purged prior to commencing micropurge activities to ensure that fresh formation water is sampled following the completion of micropurging. The discharge tube purge volume will be determined using the following equation:

Discharge Tube Volume (milliliters) = DTP * V_F

Where: DTP = Depth to the top of the pump to the nearest 0.1 foot

V_F = Volume Factor as follows:

10 = 1/4-inch diameter tubing

22 = 3/8-inch diameter tubing

39 = 1/2-inch diameter tubing

If discharge tube purging is required, the purge should be conducted at a rate equal to the well yield to avoid drawing stagnant well column water into the pump (*i.e.*, between 100 and 500 milliliters per minute). During the discharge tubing purge, the flow rate and the depth to groundwater should be monitored on regular intervals (every 3 to 5 minutes) to verify that the purge activities are not removing stagnant water from the water column in the monitoring well.

After completing the discharge tubing purge, if required, water quality parameters (pH, temperature, conductivity, and/or dissolved oxygen) along with the depth to water will be monitored during the micropurge consistent with USEPA guidance on micropurging. The stabilization of these parameters (generally +/- 10% for three consecutive readings) indicates when the discharge water is representative of formation water and samples can be collected for analysis. Measurements of turbidity may also be collected for the purpose of evaluating the purging technique. Water quality measurements will be collected on approximate 3- to 5-minute intervals and will be recorded on a Field Log or in the Field Book to document purge stabilization.

In addition to the water quality parameters, the flow rate may be monitored at regular intervals during the micropurge to verify that the micropurge activities are not removing stagnant water from the water column in the monitoring wells. In general, purge rates when using micropurge sampling procedures should not exceed 500 milliliters per minute, and the purge rate should be adjusted downward as needed to prevent the groundwater elevation from dropping more than 1 foot. Any measurements taken should be recorded on a Field Log or in the Field Book to document steady-state flow conditions during the purge. Sampling personnel will containerize and dispose of purge water generated during sampling activities in accordance with regulatory requirements.

On rare occasions, the yield of a monitoring well will be insufficient to keep up with the micropurge. In cases where the yield of the monitoring well is less than 50 milliliters per minute as documented by the recorded flow rate and continually decreasing head level as the well is purged, the required samples may be collected prior to stabilization of the water column provided the water quality parameters have stabilized within the required 10% range.

In the event that dedicated pumping equipment malfunctions during a sampling event, non-dedicated equipment may be used to micropurge the affected well(s) provided the pump can be decontaminated prior to use in each well. The pump and associated discharge hoses must be decontaminated using a non-

phosphate-based detergent and water mixture followed by a deionized water rinse to avoid cross-contamination between monitoring wells.

6.4 Sample Collection

Once the water quality data indicate that the micropurge activities have been completed, required samples should be collected directly from the discharge hose on the pump into laboratory-provided, pre-preserved sample containers selected for the required parameters or compatible parameters. Samples collected for the compliance program will not be filtered in the field or at the laboratory. Sample collection should be performed at the same rate (or lower) that was used during the micropurge. Following collection, samples will be placed in a cooler on ice under chain-of-custody control. Samples will be kept at no more than 6°C from collection to laboratory delivery.

Anticipated sample container, minimum volume, chemical preservative, and holding times for each analysis type are provided in Table 4. These standards may change depending on laboratory requirements. Sample preservation methods will be used to retard biological action, retard hydrolysis, and reduce sorption effects. These methods include chemical addition, refrigeration, and protection from light.

6.5 Sample Documentation

Chain-of-custody control is critical for documenting the integrity of the samples following collection, during transport to the laboratory, and at the laboratory. Consequently, the label for each sample container shall be completed to document the sample collection activities. An example sample container label is presented in Appendix C.

The chain-of-custody form should be signed by the sampling personnel and the receiving agent, with the date and time of transfer noted. In the event that the samples are being shipped to a laboratory, the signature of the receiving agent is not required; however, it is recommended that the tracking number for the shipping label be recorded on the chain-of-custody form. After completing the chain-of-custody form, it should be maintained with the samples. An example chain-of-custody form is presented in Appendix C.

6.6 Sample Seals

It is recommended that the shipping container be sealed to ensure that the samples have not been disturbed during transport to the laboratory. If sample seals are used, the tape should be labeled with instructions to notify the shipper if the seal is broken prior to receipt at the laboratory. An example chain-of-custody seal is presented in Appendix C.

6.7 Sample Event Documentation

The sampling event field notes should document the field activities such that they, along with the chain-of-custody form(s), are sufficient to allow for reconstruction of the sampling event by a third party.

6.8 Field Quality Assurance/Quality Control Procedures

Trip blanks, equipment blanks, and field blanks provide QA/QC measures for the monitoring program. The QA/QC measures are discussed in the following sections.

6.8.1 Trip Blanks

Trip blanks are a required part of the field sampling QA/QC program only whenever analytical parameters include volatile organic compounds (VOCs). Trip blanks are not required for this groundwater monitoring program.

6.8.2 Field Blanks

Field blanks may also be collected as part of the field sampling QA/QC program. The purpose of the field blank is to detect any contamination that might be introduced into the groundwater samples through the air or through sampling activities. At least one field blank is recommended to be collected and analyzed for the same parameters as those for which groundwater samples are analyzed.

Field blanks must be prepared in the field (at the sampling site) using laboratory-supplied bottles and deionized or laboratory reagent-quality water. Each field blank is prepared by pouring the deionized water into the sample bottles at the location of one of the wells in the sampling program. Preservatives are added to specific sample bottles as required. The well at which the field blank is prepared must be identified on the Field Log along with any observations that may help explain anomalous results (*e.g.*, prevailing wind direction, up-wind potential sources of contamination). Once a field blank is collected, it is handled and shipped in the same manner as the rest of the samples.

6.8.3 Equipment Blanks

For wells that must be sampled with non-dedicated equipment, decontamination procedures consist of rinsing the equipment once with deionized or laboratory reagent-quality water, brushing the equipment using laboratory-quality soap, and triple rinsing the equipment with deionized or laboratory reagent-quality water. One equipment blank may be collected during each sampling event and analyzed for the same parameters as those for which groundwater samples are analyzed. Equipment blanks are collected by pouring deionized or laboratory reagent-quality water into or over the sampling device (*e.g.*, the water level indicator), and then filling a set of sample bottles.

If the analytes for the equipment blank would normally be filtered, this water should be placed into a pre-filtration bottle and subsequently filtered. Whether or not it is filtered, this water is placed into the equipment blank bottles, and the proper preservative added (as required).

6.8.4 Field Duplicates

Duplicate samples are generally collected to demonstrate the reproducibility of the sampling technique. Duplicate samples may be collected on a 5% (1 in 20) frequency. This is a separate duplicate from the duplicates a laboratory must run, and cannot be replaced by a laboratory-generated duplicate. Duplicates are representative of field sampling precision, whereas laboratory duplicates are a measure of analytical precision. Both pieces of information are essential to determining the quality of data generated for a project.

6.9 Laboratory Quality Control Procedures

The quality assurance program for the selected Virginia Environmental Laboratory Accreditation Program (VELAP)-accredited analytical laboratory will be documented in their Quality Assurance Program Plan (QAPP). This document describes mechanisms employed by the VELAP-accredited laboratory to ensure that reported data meet or exceed applicable USEPA and Virginia requirements. The QAPP describes the laboratory's experience, its organizational structure, and procedures in place to ensure quality of the analytical data. The QAPP outlines the sampling, analysis, and reporting procedures used by the laboratory. The laboratory is responsible for the implementation of and adherence to the QA/QC requirements outlined in the QAPP. A copy of the laboratory's QAPP will be available to the DEQ or Station personnel upon request.

Audits are an important component of the quality assurance program at the laboratory. Audits are conducted by the laboratory. Internal system and performance audits are conducted periodically to ensure adherence by all laboratory departments to the QAPP. External audits are conducted by accrediting agencies or states. These reports are transmitted to department managers for review and response. Corrective measures must be taken for any finding or deficiency found in an audit.

Data Quality Reviews (DQRs), or equivalent, are requests submitted to the laboratory to formally review results that differ from historical results, or that exceed certain permit requirements or quality control criteria. The laboratory prepares a formal written response to DQRs explaining discrepancies. The DQR is the first line of investigation following any anomalous result.

6.9.1 Laboratory Documentation

Upon receipt of the samples at the laboratory, the following activities are recommended:

- The date, time of sample collection, and analysis to be performed will be provided to the VELAP-accredited laboratory.

- The samples will be examined upon receipt to ensure collection in USEPA-approved containers for the requested analysis. The sample collection data and time will also be reviewed to ensure the USEPA-required sample holding time has not expired or will not expire before the analysis can be performed.
- The information concerning transportation mode and manner will be reported on the form. Samples must be transported on ice or under refrigeration, and the inside temperature of the cooler recorded upon opening.
- The pH of each sample as well as the sample appearance will be recorded if required by the analytical method. Also, preservative adjustments, filtration, and sample splitting must also occur as required prior to distribution. Sample adjustments will be fully documented.

During analysis of the samples, it is recommended that the laboratory agent maintain the integrity of the samples as follows:

- During the sample analysis period, the samples will remain refrigerated.
- If at any point during the analysis process, the results are considered technically inaccurate, the analysis must be performed again if holding times have not been exceeded.

Documentation activities should be completed with permanent ink in a legible manner with mistakes crossed out with a single line.

6.9.2 Laboratory Analyses

Analytical procedures for constituents listed in Table 3.1 of the VSWMR and Appendix IV of the CCR Rule will be performed in accordance with USEPA *Test Methods for Evaluating Solid Waste - Physical/Chemical Methods, SW-846,* as updated. Analytical methods for the remaining constituents and parameters required for the monitoring program will be performed pursuant to procedures in USEPA *Test Methods for Evaluating Solid Waste - Physical/Chemical Methods, SW-846,* as updated or other USEPA-approved methods (*e.g.*, published drinking water methods, clean water act method, Standard Methods). The modified Detection Monitoring Program and modified Assessment Monitoring Program constituents, along with recommended test methods and estimated PQLs, are listed in Tables 2 and 3. Laboratory analytical results for groundwater compliance samples will be reported on a total sample basis.

6.9.3 Limits of Quantitation (LOQs)

Laboratory-specific LOQs will be used as the reporting limits for quantified detections of required monitoring constituents. Laboratory LOQs should be reported with the sample results.

6.9.4 Limits of Detection (LODs)

Laboratory-specific LODs will be used as the reporting limits for estimated detections of required monitoring constituents. Constituents detected at concentrations above the LOD but below the LOQ will be reported as estimated with a qualifying “J” flag on the laboratory certificates of analysis. It is noted that estimated

detections are not considered statistically significant and cannot trigger the Corrective Action Program. Laboratory LODs should be reported with the sample results.

6.9.5 Method Blanks

Laboratory method blanks are used during the analytical process to detect any laboratory-introduced contamination that may occur during analysis. A minimum of one method blank should be analyzed by the laboratory per sample batch.

6.9.6 Matrix Spike and Matrix Spike Duplicate Samples

A matrix spike/matrix spike duplicate sample will be run with every sample batch. The relative percent difference between the spike and the spike duplicate sample should be less than 20 percent. Higher values may indicate matrix interference.

6.10 Data Validation

The laboratory is responsible for verifying that the reported analytical results are correct. The QA/QC data provided by the laboratory will be reviewed to ensure that the analytical results meet the project's data quality objectives. The review process should be performed in general accordance with the procedures outlined in the following USEPA guidance documents:

- *National Functional Guidelines for Inorganic Superfund Methods Data Review*, January 2017 (USEPA, 2017); and
- *Multi-Agency Radiological Laboratory Analytical Protocols Manual*. (USEPA, 2004).

7.0 DATA EVALUATION

Statistical analysis of the data will be completed as discussed in the following subsections. These criteria represent a conservative approach to groundwater analysis and incorporate appropriate statistical and other evaluation methodologies.

7.1 Groundwater Data Evaluation

This section outlines the inter-well statistical evaluation methodologies that may be used to detect a release from the CCR units by comparing downgradient well results to unit-specific statistically calculated background concentrations.

During background sample collection, it will be necessary to examine the data for outliers, anomalies, and trends that might be an indication of a sampling or analytical error. Outliers and anomalies are inconsistently large or small values that can occur due to sampling, laboratory, transportation, or transcription errors, or even by chance alone. Significant trends indicate a source of systematic error, or an actual contamination occurrence, that must be evaluated and corrected before valid inter-well statistical evaluations can be implemented. The inclusion of such values in the historical database used for temporal water quality evaluations or in the unit's background database for inter-well statistical evaluations could cause misinterpretation of the data set, and result in high false positive (*i.e.*, an indication of a release when none exists) and/or false negative (*i.e.*, falsely concluding there is no release in the presence of an actual release) conclusions.

To prevent the inclusion of anomalous data in the inter-well database, background monitoring results will be evaluated during background development for any new wells constructed, once those well(s) have at least four measurements for a given constituent using time vs. concentration graphs. Parameter concentrations that appear anomalous (*i.e*., that are 5 times or greater than the previous results) may be verified during the next sample collection event or after a reasonable period of time to ensure sample independence (*e.g.*, 3 months). If the anomalous result is not verified, the outlier may be removed from the database to maintain the accuracy of the evaluation method. Any detected systematic trends or verified outliers in the background database will be evaluated and reported to the DEQ in a timely manner.

7.1.1 Correcting for Linear Trends

If a data series exhibits a linear trend, the sample will exhibit temporal dependence when tested via the sample autocorrelation function (see Section 14.2.3 of the Unified Guidance; USEPA, 2009), the rank von Neumann ratio (see Section 14.2.4 of the Unified Guidance; USEPA, 2009), or similar procedure. These data can be de-trended, much like the data in the previous example were de-seasonalized. Typically, the easiest way to de-trend observations with a linear trend is to compute a linear regression on the data (see

Section 17.3.1 of the Unified Guidance; USEPA, 2009) and then use the regression *residuals* instead of the original measurements in subsequent statistical analysis.

7.2 Statistical Methodology

In accordance with the CCR Rule §257.93(f)(6) as adopted in the VSWMR, Dominion Energy must obtain a certification from a qualified professional engineer stating that the selected statistical method is appropriate for evaluating the groundwater monitoring data for the CCR management area. The certification will include a narrative description of the statistical method selected to evaluate the groundwater monitoring data. As adopted in the VSWMR, this certification is subject to the recordkeeping requirements specified in §257.105(h), the notification requirements specified in §257.106(h), and the internet requirements specified in §257.107(h).

The statistical test used to evaluate the groundwater monitoring data will be selected based on the size of the dataset, the data distribution, and statistical level of significance requirements as allowed by the VSWMR and the CCR Rule and associated state and Federal guidance documents. Dominion Energy will ensure that an adequate number of independent samples for the chosen statistical method are collected within the compliance period such that the level of significance for individual well comparison will be no less than 0.01 and no less than 0.05 for multiple comparisons for any statistical test. Possible statistical test methods are:

- A parametric analysis of variance (ANOVA) followed by multiple comparisons procedures to identify statistically significant evidence of contamination. The method will include estimating and testing the contrasts between each compliance well's mean and the background mean levels for each constituent;
- An analysis of variance (ANOVA) based on ranks followed by multiple comparisons procedures to identify significant evidence of contamination. The method will include estimating and testing the contrasts between each compliance well's median and the background median levels for each constituent;
- A tolerance or prediction interval procedure in which an interval for each constituent is established from the distribution of the background data, and the level of each constituent in each compliance well is compared to the upper tolerance or prediction limit;
- A control chart approach that gives control limits for each constituent; or
- Another statistical test method that meets the performance standards specified by the DEQ. A justification for the alternate test method will be submitted for approval by the DEQ.

The statistical analysis chosen to evaluate the groundwater data will meet the following performance standards and will be consistent with the USEPA's *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance* (USEPA, 2009):

- The statistical method used to evaluate groundwater monitoring data shall be appropriate for the distribution of monitoring parameters or constituents. If the distribution is shown by

Dominion Energy to be inappropriate for a normal theory test, then the data should be transformed or a distribution-free theory test should be used. If the distributions for the constituents differ, more than one statistical method may be needed.

- If an individual well comparison procedure is used to compare an individual compliance well constituent concentration with background constituent concentrations or a GWPS, the test shall be done at a Type I error level no less than 0.01 for each testing period. If a multiple comparisons procedure is used, the Type I experiment-wise error rate for each testing period shall be no less than 0.05; however, the Type I error of no less than 0.01 for individual well comparisons must be maintained. This performance standard does not apply to tolerance intervals, predictions intervals, or control charts.
- If a control chart approach is used to evaluate groundwater monitoring data, the specific type of control chart and its associated parameter values shall be protective of human health and the environment. The parameters shall be determined after considering the number of samples in the background database, the data distribution, and the range of the concentration for each constituent of concern.
- If a tolerance interval or a prediction interval is used to evaluate groundwater monitoring data, the levels of confidence and, for tolerance intervals, the percentage of the population that the interval must contain, shall be protective of human health and the environment. These parameters shall be determined after considering the number of samples in the background database, the data distribution, and the range of the concentrations for each constituent of concern.
- The statistical method shall account for data below the LOD with one or more statistical procedures that shall be at least as effective as any other approach in this section for evaluating groundwater data. Any PQL that is used in the statistical method shall be the lowest concentration that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions that are available to the Station.
- If necessary, the statistical method shall include procedures to control or correct for seasonal and spatial variability as well as temporal correlation in the data.

7.2.1 Reporting of Low and Zero Values

Chemical constituents that are not present above the detection limit of the analytical procedure are reported as NOT DETECTED (ND), or less than the LOD, rather than as zero or not present, and the laboratory's LOD is provided on the analytical report. There are a several methods for dealing with data that include values below detection, and the selected method should be consistent with the USEPA's Unified Guidance (USEPA, 2009).

7.2.2 Normality Testing

The original data must be tested for normality using an appropriate method consistent with USEPA's Unified Guidance (USEPA, 2009). The following generalized guidelines should be considered for decisions in normality testing:

- If the original data show that the data are not normally distributed, then the data must be natural log-transformed and tested for normality using the above methods.
- If the original or the natural log-transformed data confirm that the data are normally distributed, then a normal distribution test must be applied.

- If neither the original nor the natural log-transformed data fit a normal distribution, then a distribution-free test must be applied.

7.2.3 Missing Data Values

Missing data values may result in an incomplete measure of environmental variability and an increased likelihood of falsely detecting contamination. If data are missing, there is a danger that the full extent of contamination may not be characterized. Therefore, resampling will occur within 30 days to replace the missing data unless an alternative schedule is otherwise approved by DEQ.

7.2.4 Outliers

An outlier is a value that is much different from most other values in a data set for a given groundwater chemical constituent. The reasons for outliers may include:

- Sampling errors or field contamination;
- Analytical errors or laboratory contamination;
- Recording or transcription errors;
- Faulty sample preparation or preservation, or shelf-life exceedance; or
- Extreme, but accurately detected environmental conditions (*e.g.*, spills, migration from the unit).

Formal testing for outliers should be done only if an observation seems particularly high (by orders of magnitude) compared to the rest of the data set. If a sample value is suspect, the value should be evaluated using the appropriate outlier test described in USEPA's *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Interim Final Guidance* (USEPA, 2009). Background observations, which are considered to be outliers, will not be included in the statistical analysis to preserve the power of the test to detect a release from the ponds.

7.3 Verification Procedure

Once groundwater analysis results have been collected, checked for QA/QC consistency, and determined to be above the appropriate statistical level, the results must be verified in accordance with the objectives of the VSWMR for groundwater monitoring. Verification re-sampling is an integral part of the statistical methodology described by USEPA's Unified Guidance (USEPA, 2009). Without verification re-sampling, much larger statistical limits would be required to achieve site-wide false positive rates of 5% or less. Furthermore, the resulting false negative rate would be greatly increased. Verification sampling should generally be performed for each constituent when it is initially determined to be present above its statistical limit. Consistent with the VSWMR, verification samples, if collected, must be obtained within the 30-day SSI determination period defined in 9VAC20-81-250.A.4.h.(2).

7.4 Comparison to Groundwater Protection Standards

Following the establishment of GWPS under the modified Assessment Monitoring Program, detected constituents will be statistically compared to the approved GWPS using one of the methods discussed below.

If the GWPS for a constituent is derived from the unit's background concentration, then the groundwater monitoring data must be compared directly to the GWPS using a value-to-value comparison. If the established GWPS is derived from a MCL (or other reference standard concentration), then the groundwater monitoring data may be compared to the GWPS statistically and/or using a value-to-value procedure. For constituents that derived GWPS from background and are not detected (100% non-detects) in upgradient monitoring wells, the double quantification rule will be used to determine downgradient exceedances. Whereas, if the constituent concentration in a compliance well exceeds the highest historical laboratory reporting limit for two consecutive events, an exceedance of GWPS will be confirmed.

Based on the above criteria, groundwater monitoring data will initially be compared to established GWPS via a value-to-value comparison. If a GWPS is exceeded during the value-to-value comparison for any parameter, a verification sample may be collected. The results from the verification sample will be compared to the GWPS via a value-to-value comparison. If the comparison indicates a GWPS exceedance, the source of the GWPS will be determined. If the GWPS is derived from a MCL, two additional groundwater samples for the suspect constituent(s) may be collected to facilitate a statistical comparison to the GWPS. It is noted that verification sampling and/or additional sampling required to perform a statistical evaluation must occur within the same compliance monitoring period during which the original samples were collected. The compliance monitoring period begins on the day of sampling and expires 6 months later, or the date of the next compliance sampling event, whichever occurs first.

To perform a statistical comparison, a minimum of four samples must be collected within the compliance monitoring period. Once data have been received for the four samples, then the lower confidence interval can be calculated and compared to the GWPS. The lower limit should be calculated initially by using a 95% confidence level. If the lower limit exceeds the GWPS, the DEQ may be contacted regarding the use of a confidence level greater than 95%.

8.0 HYDROGEOLOGIC ASSESSMENT

After each sampling event, groundwater surface elevations will be evaluated to determine whether the requirements for locating the monitoring wells continue to be satisfied and the rate and direction of groundwater flow will be determined. Groundwater elevations in monitoring wells must be measured within a period of time short enough (typically within 24 hours) to avoid temporal variations in groundwater flow that could preclude accurate determination of groundwater flow rate and direction.

The rate and direction of groundwater flow will be determined each time groundwater is sampled by comparing the groundwater surface elevations among the monitoring wells, and at least annually, constructing a groundwater surface contour map. The groundwater flow rate shall be determined using the following equation:

$$V_{gw} = K\, i\, (1/n_e)$$

Where:

V_{gw} = Groundwater velocity
K = Hydraulic conductivity
i = Hydraulic gradient
n_e = Effective porosity

If the evaluation shows that the groundwater monitoring system does not satisfy the requirements of the VSWMR, the monitoring system will be modified to comply with those regulations after obtaining approval from the DEQ. Dominion Energy will request the appropriate permit amendment action related to any revisions of the monitoring well network(s) deemed necessary due to a change in groundwater flow pattern or functionality of any monitoring well. Proposed revisions will be submitted to the DEQ within 30 days of determining that the system does not satisfy the requirements of the VSWMR; the modifications may include a change in the number, location, or depth of the monitoring wells.

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